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(54) Improvements in or relating to fire doors.

(57) A fire door includes a timber frame (1) whose inwardly facing sides are rebated (2) to receive and retain side edges of a sheet of a fire resistant mortar comprising a calcium aluminate cement and an inorganic fibre material. The fire resistant mortar completely fills the interior of the timber frame.

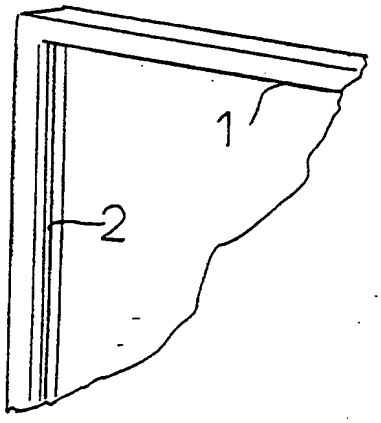

FIG.1

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This invention relates to fire doors.

Internal timber framed fire doors are known in which the door interior is filled with layers of plasterboard or chipboard. Such doors provide only limited fire protection of, for example, up to half an hour, and rapidly become unstable in the presence of fire.

The present invention sets out to provide a timber framed fire door capable of providing greatly increased fire protection and typically of the order of two to three hours.

According to the present invention there is provided a fire door including a timber frame whose inwardly facing sides are rebated to receive and retain side edges of a sheet of a fire resistant mortar comprising a calcium aluminate cement and an inorganic fibre material, the fire resistant mortar completely filling the interior of the timber frame.

In another aspect there is provided a timber framed fire door which comprises a sheet of fire resistant mortar produced from calcium aluminate cement and an inorganic fibre material sandwiched between sheets or boards of thermally insulating fire resistant material, side edges of the sheet of fire resistant mortar being rebated into channels formed in the inwardly facing sides of the timber frame.

In a still further aspect the present invention provides a method of producing a fire door which comprises the steps of forming rebate channels within the inwardly facing sides of a timber frame, locating a sheet or board of thermally insulating fire resistant material within and to one side of the frame, pouring into the frame interior and onto the thermally insulating sheet or board a quantity of fire resistant mortar completely to fill the frame interior and the side channels, allowing the mortar to set, and placing on the exposed surface of the mortar either before or after setting of the mortar a further sheet or board of thermally insulating material.

Layers of intumescent paper may be secured by, for example, adhesive to the outer faces of the sheets or bards of thermally insulating material.

The inorganic fibre material is preferably a ceramic fibre (eg an aluminer silicate fibre) or a manmade mineral fibre such as rockwool fibre or glassfibre.

Preferably the mortar contains up to about 85% by weight of inorganic fibre material. Inorganic fibres may be formulated together with a binder, for example a polymeric binder such as polyacrylate or a polyvinylacetate. In one embodiment the mortar contains up to about 85% by weight of a mixture of the inorganic fibre and a binder. More preferably the mortar contains within 60% and 80% by weight of the inorganic fibres. A mixture of inorganic fibre and binder can contain up to about 50% by weight by binder, and more particularly contains up to about 10% by weight of binder.

A typical composition of a suitable calcium aluminate cement, as determined by chemical analysis, is 38% to 40% Al_2O_3, 37% to 39% CaO, 3% to 5% SiO_2 and 15% to 18% Fe_2O_3 /FeO. The cement may contain a mixture of noncalcium aluminates, dicalcium silicate and calcium aluminate.

An example of a calcium aluminate cement suitable for use in mortar used in fire doors in accordance with the present invention is "Ciment Fondu Lafarge" manufactured by the Lafarge Aluminous Cement Company Limited of Grays, Essex, United Kingdom.

The mortar may include an accelerator to accelerate the hardening of the mortar. In one embodiment the fire mortar composition may contain a mixture of accelerated and non-accelerated calcium aluminate cement. For example the accelerated calcium aluminate cement may be an accelerated form of Ciment Fondu Lafarge available from Lafarge Aluminous Cements of Grays, Essex, United Kingdom.

The thermally insulating fire resistant ceramic sheet may be formed from rockwool or similar manmade mineral fibres.

The intumescent material may be in sheet form or may take the form of an intumescent coating which is applied to the external faces of the thermally insulating fire resistant sheets or boards. The intumescent material may comprise an intumescent substance such as an alkaline metal silicate, eg a sodium silicate, or other intumescent substances such as exfoliating graphite. The intumescent material typically also contains a binding agent, most usually a polymeric binding substance such as a polyacrylate or derivative thereof, or a polyvinylacetate.

The invention will now be described by way of example only with reference to the accompanying diagrammatic drawings in which:-

Figure 1 is a partial perspective view of a timber frame of a fire door in accordance with the invention; and

Figure 2 is a cross section taken through a fire door in accordance with the invention.

The fire door illustrated comprises a hardwood frame 1 formed with an internal rebate 2. The interior of the door comprises outer sheets or coatings of intumescent material 3, sheets or boards (referred to hereinafter simply as "sheets") of thermally insulating heat resistant material, 4, 5 and an inner sheet or layer 6 of fire resistant mortar. The sheets 4, 5 are preferably ceramic sheets typically of 4mm thickness and the sheet or layer or mortar is typically of 20mm thickness. The sheets or coatings 3 may comprise sheets of intumescent paper or may comprise an intumescent wash or paint applied as a spray or by use of a brush. The sheet or layer of fire mortar 6 is firmly retained in place by its side edges which extend into the internal rebate 2 of the frame 1.

For assembly, the sheet 4 of thermally insulating heat resistant material is positioned within the hardwood frame and is dimensioned to define a close fit

with the frame internal boundary. Fire resistant mortar is then poured as a fluid onto the exposed face of the ceramic sheet 4 and into the frame 1 completely to fill the rebate 2 and the frame interior. The sheet 5 of thermally insulating material is then placed onto the exposed surface of the mortar which is then allowed to set. Setting typically takes approximately three hours to complete. The intumescent material 3 may then be applied to the outer faces of the ceramic sheets 4, 5 either by an adhesive if in sheet form or as a coating.

Decorative panels may be secured to the coated exposed faces of the ceramic sheets 4,5 and, to complete the door, edging trim may be applied to the upright stile and head of the door. Typically the edging trim comprises a surface mounted strip of intumescent material from which protrudes a brush seal.

The fire resistant mortar comprises a mix of a calcium aluminate cement and an inorganic fibre material, preferably a ceramic fibre, eg an alumina silicate fibre, or a manmade mineral fibre such as rockwool fibre or glassfibre. The mortar typically contains up to about 85% by weight inorganic fibre material. The inorganic fibre may be formulated together with a binder, for example a polymeric binder such as polyacrylate or a polyvinylacetate. In one embodiment the mortar contains up to about 85% by weight of a mixture of the inorganic fibre and a binder. More typically the mortar contains between 60% and 80% by weight of the inorganic (eg ceramic) fibre. The mixture of inorganic fibre and binder can contain up to about 15% by weight of binder, more typically about 10% by weight of binder.

Typical formulations of calcium aluminate cement are set out in the introduction to this specification.

The thermally insulating fire resistant sheet or board material is typically a ceramic board of known type or a board formed from rockwool or similar manmade mineral fibres.

Fire doors in accordance with the invention are capable of withstanding temperatures in access of 15°C for periods for example of up to 3 hours.

It will be appreciated that the fire door described above is merely exemplary of fire doors in accordance with the invention and that modifications can readily be made thereto without departing from the true scope of the invention as set out in the appended claims.

Claims

1. A fire door which is characterised in that it includes a timber frame (1) whose inwardly facing sides are rebated to receive and retain side edges of a sheet of a fire resistant mortar (6) comprising a calcium aluminate cement and an inorganic fibre material, the fire resistant mortar completely filling the interior of the timber frame.

2. A timber framed fire door which is characterised in that it comprises a sheet of fire resistant mortar (6) produced from calcium aluminate cement and an inorganic fibre material sandwiched between sheets or boards (4,5) of thermally insulating fire resistant material, side edges of the sheet of fire resistant mortar being rebated into channels (2) formed in the inwardly facing sides of the timber frame.

3. A fire door as claimed in Claim 1 or Claim 2 characterised in that the inorganic fibre material is a ceramic or manmade fibre.

4. A fire door as claimed in Claim 1 or Claim 2 characterised in that the inorganic fibre material comprises alumina silicate fibres.

5. A fire door as claimed in Claim 1 or Claim 2 characterised in that the inorganic fibre material comprises rockwool fibres or glassfibres.

6. A fire door as claimed in any one of Claims 1 to 5 characterised in that the mortar contains up to 85% by weight of inorganic fibre material.

7. A fire door as claimed in any one of Claims 1 to 6 characterised in that the intumescent material takes the form of an intumescent coating which is applied to the external faces of the sheet of thermally insulating fire resistant sheet.

8. A fire door as claimed in any one of the preceding Claims characterised in that the intumescent material comprises an alkaline metal silicate.

9. A fire door as claimed in any one of Claims 1 to 7 characterised in that the intumescent material comprises exfoliating graphite.

10. A method of producing a fire door which is characterised by the steps of forming rebate channels within the inwardly facing sides of a timber frame, locating a sheet or board of thermally insulating fire resistant material within and to one side of the frame, pouring into the frame interior and onto the thermally insulating sheet or board a quantity of fire resistant mortar completely to fill the frame interior and the side channels, allowing the mortar to set, and placing on the exposed surface of the mortar either before or after setting of the mortar a further sheet or board of thermally insulating material.

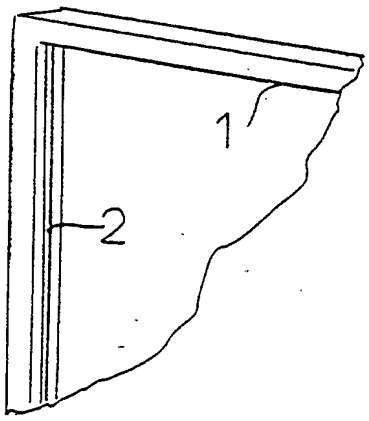

FIG.1

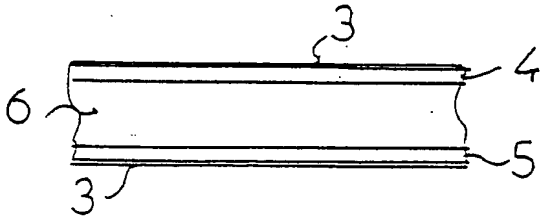

FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 95 30 1709

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	FR-A-2 695 159 (OLIVIER SA) 4 March 1994 * page 3, line 14 - page 4, line 14 * * page 4, line 30 - page 5, line 8; figures *	1-5	E06B5/16
Y	GB-A-1 498 966 (CAPE BOARDS & PANELS LTD) 25 January 1978 * page 1, line 47 - line 74 * * page 2, line 18 - line 34 *	1-5	
A	DE-A-21 66 616 (PROMAT) 2 January 1975 * page 4, line 7 - line 10 *	2	
A	GB-A-1 288 613 (CAPE INSULATION LTD.) 13 September 1972 * the whole document *	1,5,6	
A	US-A-4 661 398 (ELLIS HAROLD) 28 April 1987 * column 9, line 1 - column 10, line 56; example 3 *	1	
A	US-A-4 015 386 (COOK SANFORD L) 5 April 1977 * column 2, line 28 - line 50 *	7,8	TECHNICAL FIELDS SEARCHED (Int.Cl.6) E06B E04B C04B
A	US-A-4 015 393 (WARWICK CHARLES HERBERT) 5 April 1977 * the whole document *	1,2,10	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	5 July 1995	Fordham, A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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